DEVELOPMENT OF TECHNOLOGY FOR EXTRACTING PRECIOUS METALS FROM SLAGS OF COPPER SMELTING PLANTS.

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Abstract. Copper smelting slags are a significant secondary resource containing valuable metals such as gold, silver, and platinum group elements. However, conventional extraction technologies often result in substantial metal losses and environmental challenges. This article explores modern approaches to improving the recovery of precious metals from copper smelting slags, focusing on advanced physical, chemical, and combined treatment methods.

Keywords. Copper slag, precious metals, extraction technology, hydrometallurgy, pyrometallurgy, slag processing, sustainability.

Introduction. The rapid growth of the metallurgical industry and the increasing demand for precious metals such as gold, silver, and platinum group elements have intensified the need for efficient resource utilization. Copper smelting plants generate large volumes of slag as a by-product, which has traditionally been treated as waste. However, modern studies have shown that these slags contain significant amounts of valuable metals, including copper and trace concentrations of precious metals that remain unrecovered during primary smelting processes.The presence of these metals in slag is mainly due to incomplete separation during smelting, as well as their fine dispersion within complex silicate matrices. As high-grade primary ores become depleted, copper slags are increasingly viewed as an important secondary resource, contributing to the concept of sustainable and circular metallurgy. Recovering valuable metals from these materials not only improves economic efficiency but also reduces environmental impacts associated with waste disposal. Despite its potential, the extraction of precious metals from copper slag remains a challenging task. The metals are often encapsulated within glassy or crystalline phases, making their liberation and recovery difficult using conventional methods. Traditional pyrometallurgical techniques, while effective, are energy-intensive and environmentally demanding. On the other hand, hydrometallurgical and physical beneficiation methods offer advantages in selectivity and lower energy consumption but may suffer from slow kinetics and incomplete recovery. Composition and Characteristics of Copper Slags.Copper slags are complex materials composed mainly of iron silicates, oxides, and minor quantities of non-ferrous and precious metals. The valuable metals are often finely dispersed or chemically bound within the slag matrix, making their extraction technically challenging. Key challenges include:

- Low concentration of precious metals
- Fine particle distribution
- Strong chemical bonding within silicate structures

Environmental and Economic Considerations

Improving extraction technologies not only increases metal recovery but also reduces environmental impact by:

- Minimizing waste accumulation
- Lowering toxic emissions
- Promoting circular economy practices

Economically, recovering precious metals from slag can significantly enhance profitability, especially as ore grades decline globally.

Conclusion. The recovery of precious metals from copper smelting slags represents a critical opportunity for both economic gain and environmental sustainability. Advancements in combined processing techniques, innovative reagents, and modern technologies can significantly improve extraction efficiency. Continued research and industrial implementation are essential to fully realize the potential of these secondary resources.

Literature used.

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